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# ALL mXTEND™: A STANDARD ANTENNA SOLUTION FOR MOBILE FREQUENCY BANDS

USER MANUAL
ALL mXTEND™ (NN02-220)

## ALL mXTEND™ : A STANDARD ANTENNA SOLUTION FOR MOBILE FREQUENCY BANDS

Ignion specializes in enabling effective mobile communications. Using Ignion technology, we design and manufacture optimized antennas to make your wireless devices more competitive. Our mission is to help our clients develop innovative products and accelerate their time to market through our expertise in antenna design, testing and manufacturing.

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ALL mXTEND™ chip antenna component

NN02-220



Ignion is an ISO 9001:2015 certified company. All our antennas are lead-free and RoHS compliant.

ISO 9001:2015 Certified

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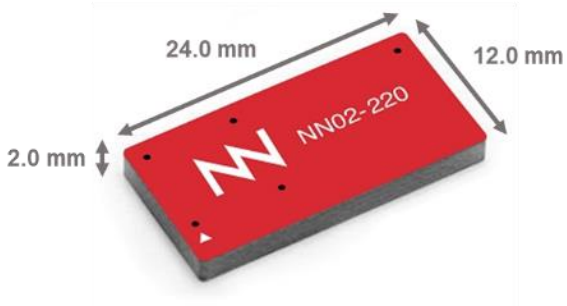
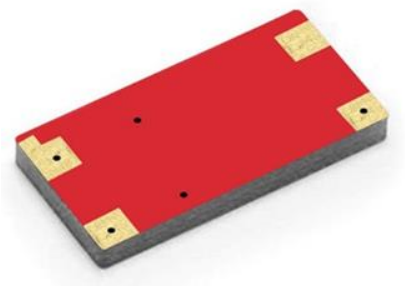
# 1. ANTENNA DESCRIPTION

The ALL mXTEND™ chip antenna component has been specifically designed for providing multiband performance in wireless devices (in particular in mobile devices), enabling worldwide coverage by allowing operation in the communication standards GSM850, GSM900, GSM1800/DCS, GSM1900/PCS, UMTS, LTE700, LTE800, LTE850, LTE900, LTE1700, LTE1800, LTE1900, LTE2000, LTE2100, LTE2300, LTE2500, and LTE2600.

**TOP**




**BOTTOM**



**Material:** The ALL mXTEND™ chip antenna component is built on glass epoxy substrate.

**APPLICATIONS**

- Handsets
- Smartphones
- Tablets
- Phablets
- Laptop PCs
- Netbooks
- Modules
- Routers
- eBooks

**BENEFITS**

- High efficiency
- Small size
- Cost-effective
- Easy-to-use (pick and place)
- Multiband behaviour (worldwide standards)
- Off-the-Shelf Standard Product (no customization is required)

The ALL mXTEND™ chip antenna component belongs to a new generation of antenna solutions based on the Virtual Antenna™ technology owned by Ignion. The technology is mainly focused on replacing conventional antenna solutions by miniature and standard components.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 674491

# 2. QUICK REFERENCE GUIDE

| Technical features | 698 – 960 MHz | 1710 – 2690 MHz |
|---|---|---|
| **Average Efficiency** | > 55 % | > 75 % |
| **Peak Gain** | 2.3 dBi | 3.1 dBi |
| **VSWR** | < 3:1 | |
| **Radiation Pattern** | Omnidirectional | |
| **Polarization** | Linear | |
| **Weight (approx.)** | 1.23 g | |
| **Temperature** | -40 to +125 ºC | |
| **Impedance** | 50 Ω | |
| **Dimensions (L x W x H)** | 24.0 mm x 12.0 mm x 2.0 mm | |

**Table 1 –** Technical features. Measures from the Evaluation Board. See Figure 1. Note that for obtaining comparable results, a ground plane length larger than 100 mm is recommended.

# 3. ELECTRICAL PERFORMANCE

## 3.1. EVALUATION BOARD

This Evaluation Board (part number: EB_NN02-220-1B-2R-1P) integrates one ALL mXTEND™ chip antenna component to provide operation in two frequency regions, from 698 MHz to 960 MHz and from 1710 MHz to 2690 MHz. A UFL cable connects this single input/output port to the SMA connector.

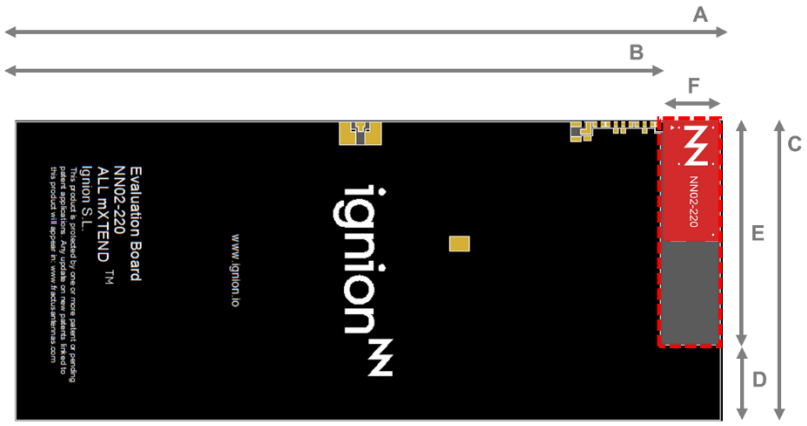



**Figure 1 –** EB_NN02-220. Evaluation Board 1 port providing operation in 2 frequency ranges, 698 – 960MHz and 1710 – 2690MHz.

| Measure | mm |
|---|---|
| **A** | 142 |
| **B** | 130 |
| **C** | 60 |
| **D** | 15 |
| **E** | 45 |
| **F** | 12 |

**Tolerance**: ±0.2 mm

**Material:** The Evaluation Boards are built on FR4 substrate. Thickness is 1 mm.

**Clearance Area**: 45 mm x 12 mm (ExF)

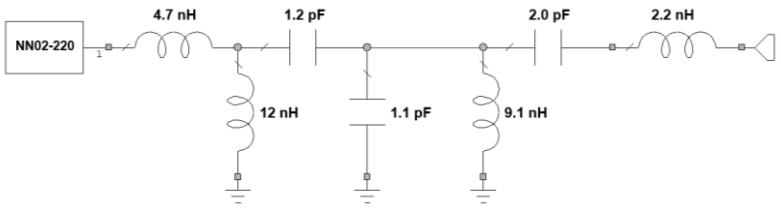
This product and its use are protected by at least one or more of the following patents and patent applications PAT. US 9,130,259 B2; PAT. US 8,237,615 B2; and other domestic and international patents pending. Additional information about patents related to this product is available at www.ignion.io/virtual-antenna/.

## 3.2. MATCHING NETWORK

The specs of a Ignion standard product are measured in their Evaluation Board, which is an ideal case. In a real design, components nearby the antenna, LCD's, batteries, covers, connectors, etc. affect the antenna performance. This is the reason why it is highly recommended placing pads compatible with 0402 and 0603 SMD components for a matching network as close as possible to the feeding point. Do it in the ground plane area, not in the clearance area. This provides a degree of freedom to tune the ALL mXTEND™ chip antenna component once the design is finished and considering all elements of the system (batteries, displays, covers, etc.).

Please notice that different devices with different ground planes and different components nearby the ALL mXTEND™ antenna component may need a different matching network. To ensure optimal results, the use of high Q and tight tolerance components is highly recommended (Murata components). If you need assistance to design your matching network beyond this application note, please contact support@ignion.io, or try our free-of-charge[1] **NN Wireless Fast-Track** design service, you will get your chip antenna design including a custom matching network for your device in 24h[1]. Other related to NN's range of R&D services is available at: https://www.ignion.io/rdservices/

**698 MHz – 960 MHz and 1710 MHz – 2690 MHz**




| Value | Part Number |
|---|---|
| **4.7 nH** | LQW15AN4N7B80 |
| **12 nH** | LQW15AN12NG00 |
| **1.2 pF** | GJM1555C1H1R2WB01 |
| **1.1 pF** | GJM1555C1H1R1WB01 |
| **9.1 nH** | LQW15AN9N1G00 |
| **2.0 pF** | GJM1555C1H2R0WB01 |
| **2.2 nH** | LQW15AN2N2B80 |

**Figure 2 –** Matching network implemented in the Evaluation Board 1 port (Figure 1).

[1] See terms and conditions for a free NN Wireless Fast-Track service in 24h at: https://www.ignion.io/fast-track-project/

## 3.3. VSWR AND EFFICIENCY

VSWR (Voltage Standing Wave Ratio) and Total Efficiency versus Frequency (GHz).

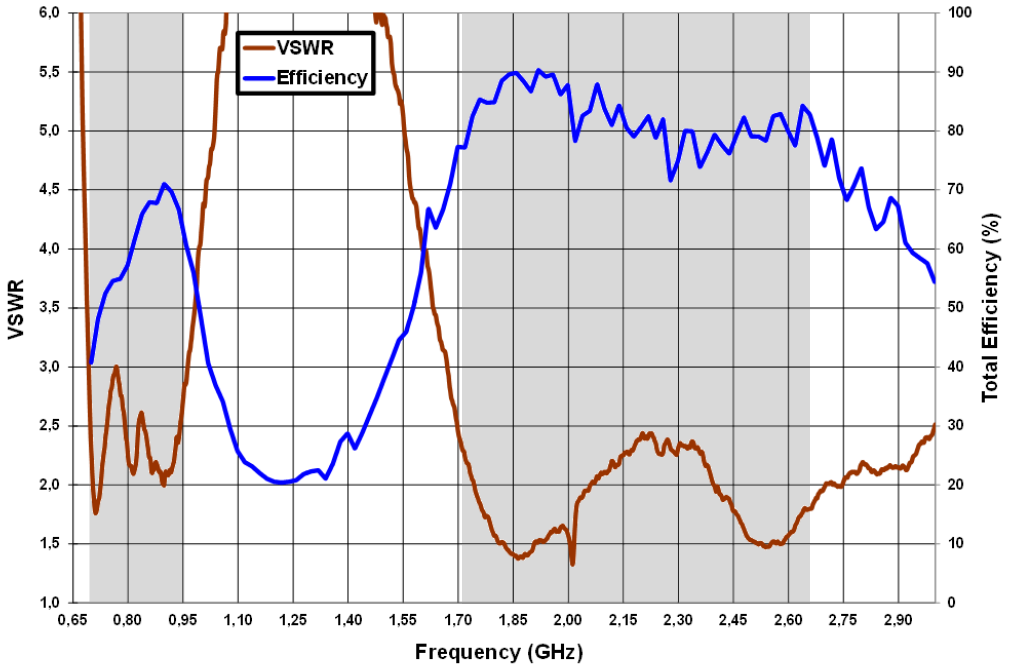
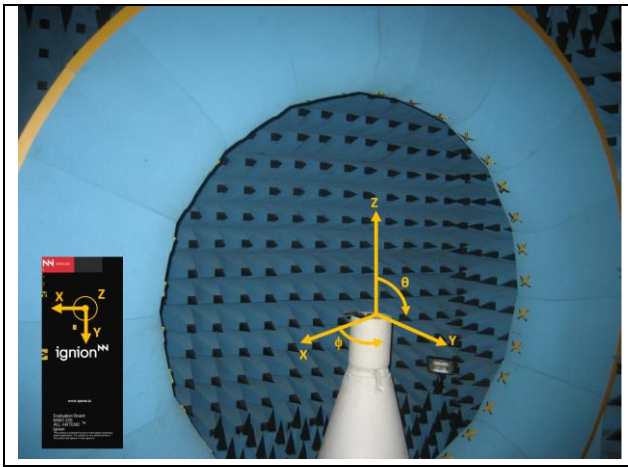
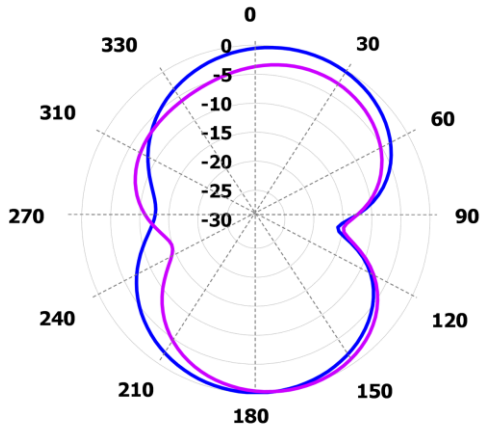



**Figure 3 –** VSWR and Total Efficiency for the 698 – 960 MHz frequency range and for the 1710 – 2690 MHz frequency range (from the Evaluation Board) (Figure 1).

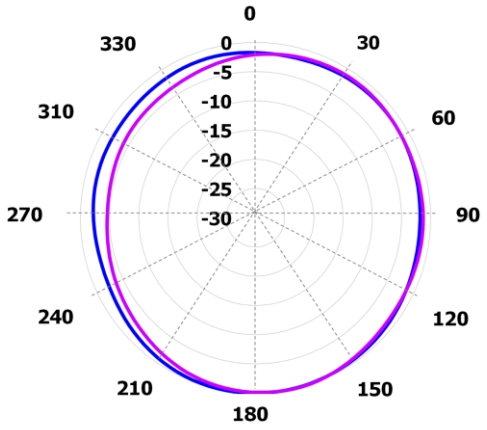
## 3.4. RADIATON PATTERNS (698-960 MHz), GAIN AND EFFICIENCY



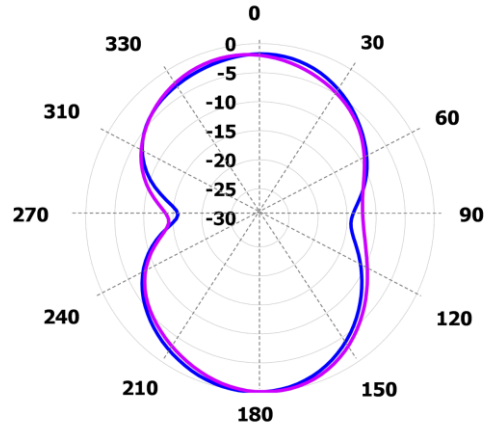

Measurement System Set-Up
Evaluation Board in Plane XY




θ = 90º Plane XY at 750 MHz and 890 MHz




ϕ = 0º Plane XZ at 750 MHz and 890 MHz

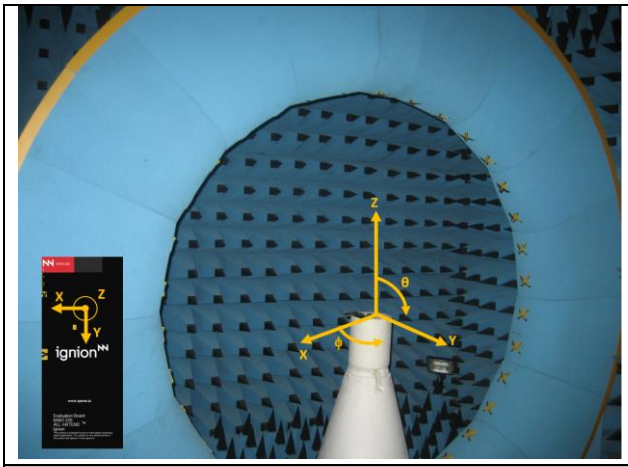



ϕ = 90º Plane YZ at 750 MHz and 890 MHz

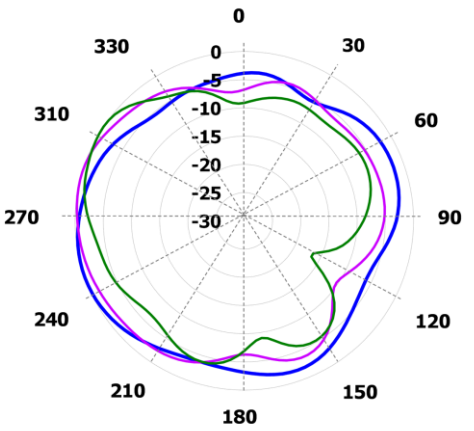
| | | |
|---|---|---|
| **Gain** | **Peak Gain** | 2.3 dBi |
| | **Average Gain across the band** | 0.8 dBi |
| | **Gain Range across the band (min, max)** | -0.8 **<–>** 2.3 dBi |
| **Efficiency** | **Peak Efficiency** | 71.1 % |
| | **Average Efficiency across the band** | 60.7 % |
| | **Efficiency Range across the band (min, max)** | 40.2 – 71.1 % |

**Table 2 –** Antenna Gain and Total Efficiency from the Evaluation Board (Figure 1) within the 698 – 960 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

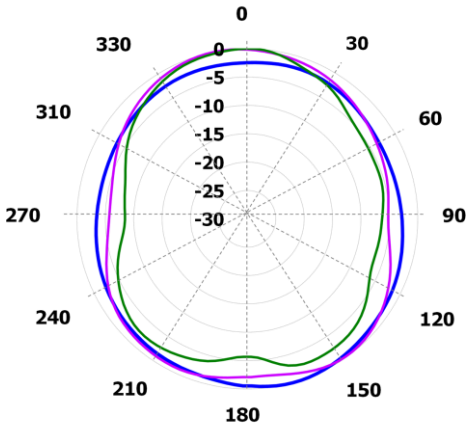
## 3.5. RADIATON PATTERNS (1710-2690 MHz), GAIN AND EFFICIENCY



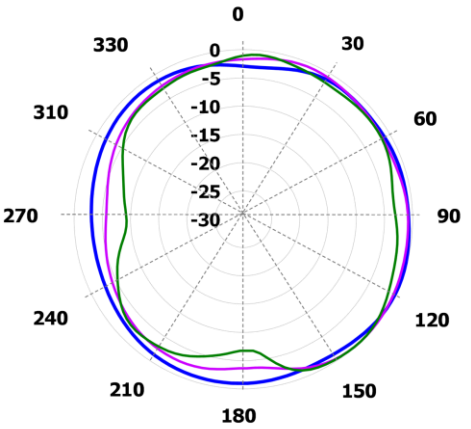

Measurement System Set-Up Evaluation Board in Plane XY




θ = 90º Plane XY at 1.71 GHz, 2.2 GHz and 2.69 GHz




ϕ = 0º Plane XZ at 1.71 GHz, 2.2 GHz and 2.69 GHz



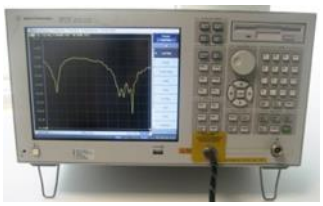

ϕ = 90º Plane YZ at 1.71 GHz, 2.2 GHz and 2.69 GHz

| | | |
|---|---|---|
| **Gain** | **Peak Gain** | 3.1 dBi |
| | **Average Gain across the band** | 2.5 dBi |
| | **Gain Range across the band (min, max)** | 1.6 **<–>** 3.1 dBi |
| **Efficiency** | **Peak Efficiency** | 90.3 % |
| | **Average Efficiency across the band** | 82.1 % |
| | **Efficiency Range across the band (min, max)** | 71.6 – 90.3 % |

**Table 3 –** Antenna Gain and Total Efficiency for the Evaluation Board (Figure 1) within the 1710 – 2690 MHz frequency range. Measures made in the Satimo STARGATE 32 anechoic chamber.

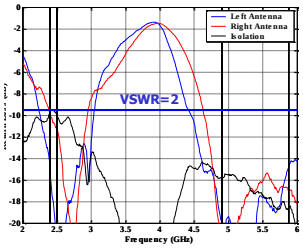
# 3.6. CAPABILITES AND MEASUREMENT SYSTEMS

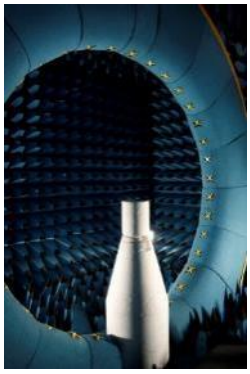
Ignion specializes in designing and manufacturing optimized antennas for wireless applications and providing our clients with RF expertise. We offer turn-key antenna products and antenna integration support to minimize your time requirement and maximize your return on investment during your product development efforts. We also provide our clients with the opportunity to leverage our in-house testing and measurement facilities to obtain accurate results quickly and efficiently.



**Agilent E5071B**

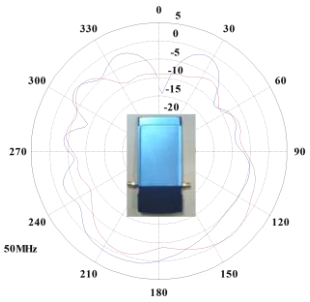
VSWR
&
S Parameters



**SATIMO STARGATE 32**

Radiation
Pattern
&
Efficiency

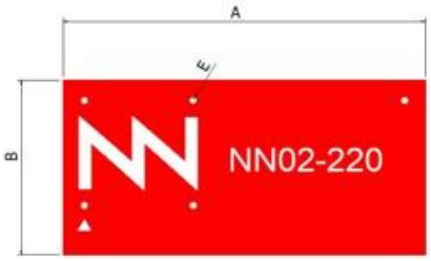



**Anechoic chambers and full equipped in-house lab**

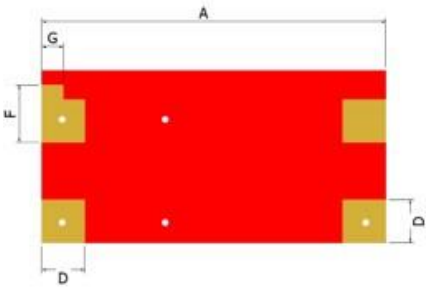
# 4. MECHANICAL CHARACTERISTICS

## 4.1. DIMENSIONS AND TOLERANCES

**TOP**




**BOTTOM**




**SIDE**

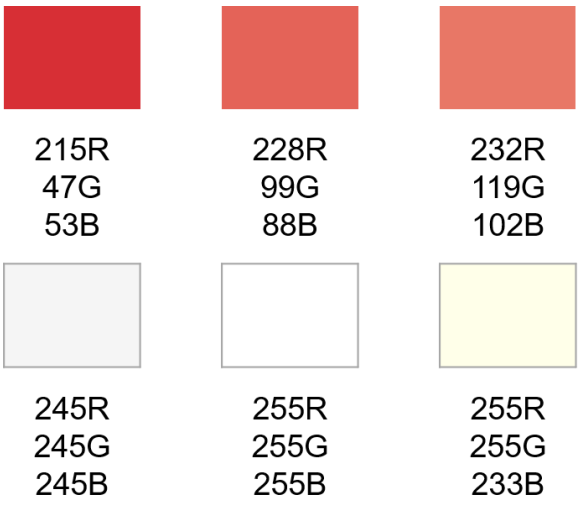

| Dimension | mm | Dimension | mm |
|---|---|---|---|
| **A** | 24.0 ± 0.15 | **B** | 12.0 ± 0.15 |
| **C (height)** | 2.0 + 0.2 - 0.1 | **D** | 3.0 ± 0.05 |
| **E** | 0.5 ± 0.05 | **F** | 4.0 ± 0.05 |
| **G** | 1.5 ± 0.05 | | |

**Figure 4 –** ALL mXTEND™ chip antenna component dimensions and tolerances.

The ALL mXTEND™ chip antenna component NN02-220 is compliant with the restriction of the use of hazardous substances (**RoHS**). For more information, please contact support@ignion.io.

## 4.2. SPECIFICATIONS FOR THE INK

Next figure shows the range of the colors in the ALL mXTEND™ chip antenna component:




**Acceptable color range**

## 4.3. ANTENNA FOOTPRINT

Assuming that the ALL mXTEND™ chip antenna component NN02-220 is placed in the clearance area of the PCB, see below the recommended footprint dimensions.

| Measure | mm |
|---|---|
| **A** | 18.0 |
| **B** | 4.0 |
| **C** | 3.1 |
| **D** | 3.1 |
| **E** | 2.0 |

**Tolerance**: ±0.05mm

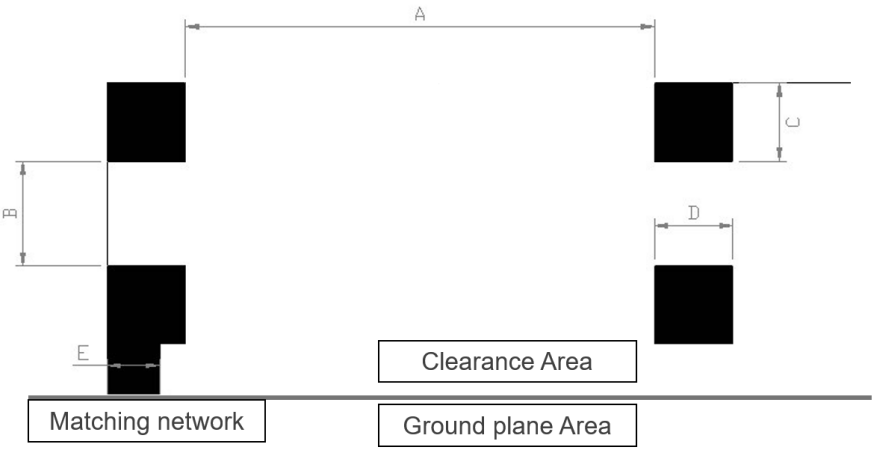



**Figure 5 –** Footprint dimensions for the single chip antenna component.

For additional support in the integration process, please contact support@ignion.io.

# 5. ASSEMBLY PROCESS

Figure 6 shows the back and front views of the ALL mXTEND™ chip antenna component NN02-220. Due to the product configuration, the feeding pad can only be the pad 1.

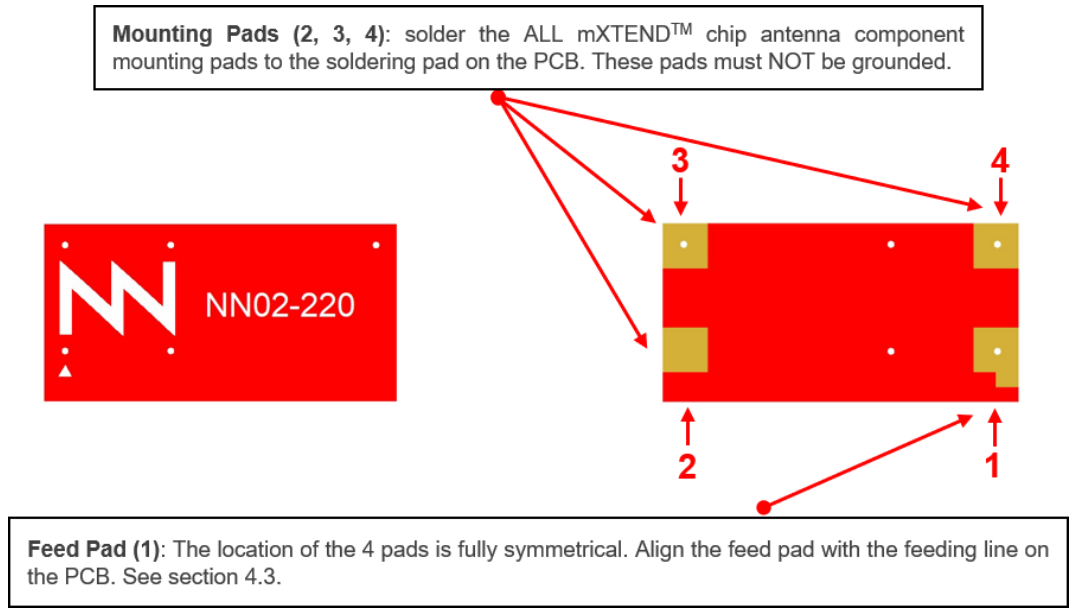


**Figure 6 –** Pads of the ALL mXTEND™ chip antenna component NN02-220.

As a surface mount device (SMD), the ALL mXTEND™ chip antenna component is compatible with industry standard soldering processes. The basic assembly procedure for the ALL mXTEND™ chip antenna component is as follows:

1. Apply a solder paste on the pads of the PCB. Place the ALL mXTEND™ chip antenna component on the board.
2. Perform a reflow process according to the temperature profile detailed in Table 4, Figure 8.
3. After soldering the ALL mXTEND™ chip antenna component to the circuit board, perform a cleaning process to remove any residual flux. Ignion recommends conducting a visual inspection after the cleaning process to verify that all reflux has been removed.

The drawing below shows the soldering details obtained after a correct assembly process:

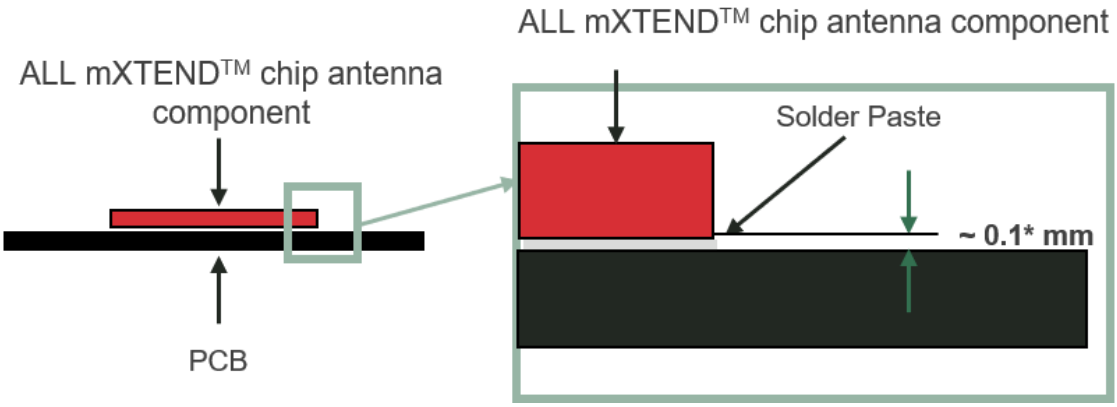



**Figure 7 –** Soldering Details.

**NOTE(*):** Solder paste thickness after the assembly process will depend on the thickness of the soldering stencil mask. A stencil thickness equal or larger than **127 microns (5 mils)** is required.

The ALL mXTEND™ chip antenna component NN02-220 can be assembled following the Pb-free assembly process. According to the Standard **IPC/JEDEC J-STD-020C**, the temperature profile suggested is as follows:

| Phase | Profile features | Pb-Free Assembly (SnAgCu) |
|---|---|---|
| **RAMP-UP** | Avg. Ramp-up Rate (Tsmax to Tp) | 3 ºC / second (max.) |
| **PREHEAT** | - Temperature Min (Tsmin)<br>- Temperature Max (Tsmax)<br>- Time (tsmin to tsmax) | 150 ºC<br>200 ºC<br>60-180 seconds |
| **REFLOW** | - Temperature (TL)<br>- Total Time above TL (tL) | 217 ºC<br>60-150 seconds |
| **PEAK** | - Temperature (Tp)<br>- Time (tp) | 260 ºC<br>20-40 seconds |
| **RAMP-DOWN** | Rate | 6 ºC/second max |
| **Time from 25 ºC to Peak Temperature** | | 8 minutes max |

**Table 4 –** Recommended soldering temperatures.

Next graphic shows temperature profile (grey zone) for the ALL mXTEND™ chip antenna component assembly process reflows ovens.

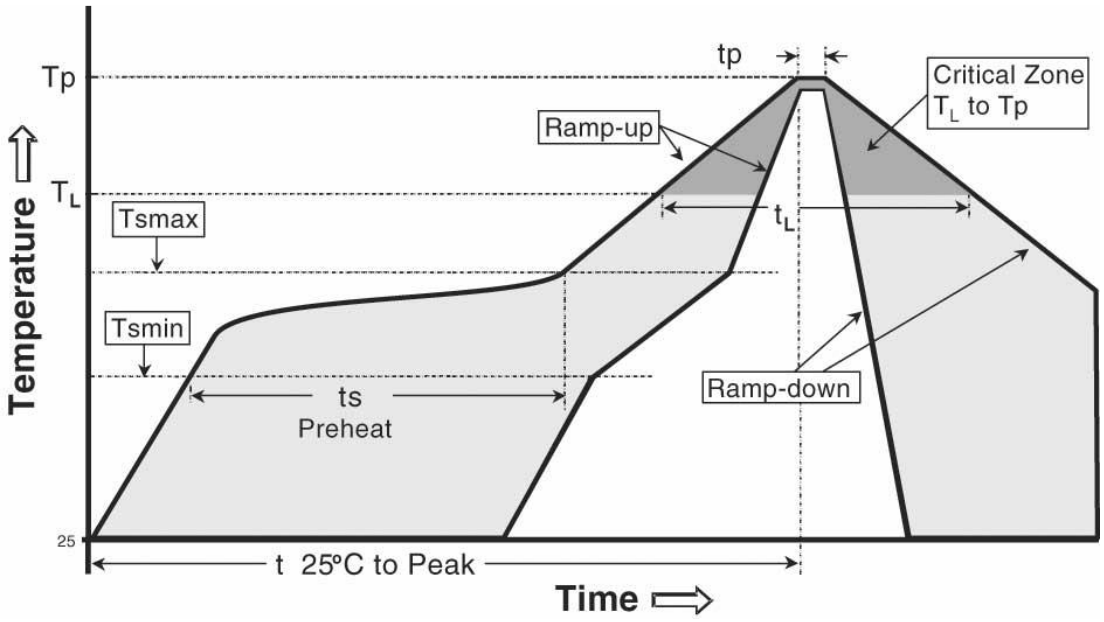
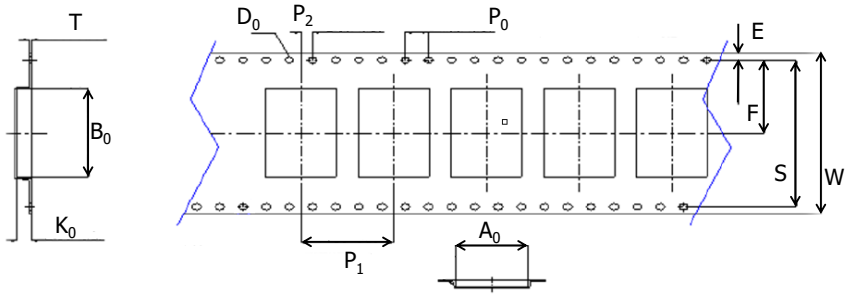



**Figure 8 –** Temperature profile.

# 6. PACKAGING

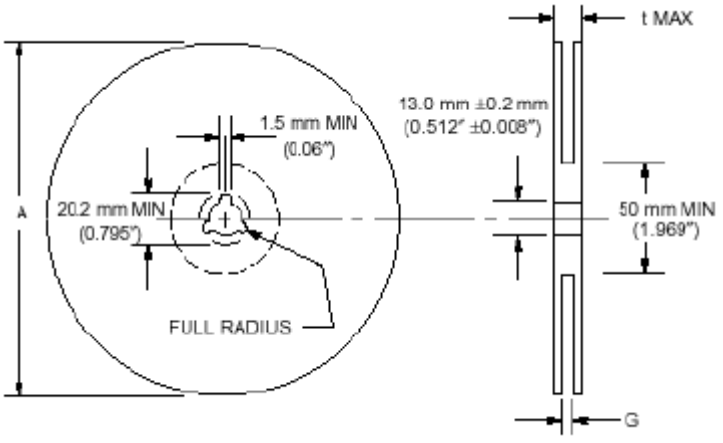
The ALL mXTEND™ chip antenna component NN02-220 is delivered in tape and reel packaging.




| Measure | mm |
|---|---|
| **Ao** | 12.3 ± 0.1 |
| **Bo** | 24.3 ± 0.1 |
| **Ko** | 2.5 ± 0.1 |
| **W** | 44.0 ± 0.3 |
| **$D_0$** | 1.55 ± 0.05 |
| **$P_1$** | 16.0 ± 0.1 |
| **$P_0$** | 4.0 ± 0.1 |
| **$P_2$** | 2.0 ± 0.1 |
| **E** | 1.75 ± 0.1 |
| **F** | 20.2 ± 0.1 |
| **S** | 40.4 ± 0.3 |
| **T** | 0.3 ± 0.05 |

**Figure 9 –** Tape dimensions and Tolerances.

**Figure 10 –** Image of the reel.




| Measure | mm |
|---|---|
| **A** | 330 ± 1.0 |
| **G** | 17.5 ± 0.2 |
| **tMAX** | 21.5 ± 0.2 |

**Reel Capacity**: 1500 pcs

**Figure 11 –** Reel Dimensions and Capacity.

# 7. PRODUCT CHANGE NOTIFICATION

**This document is property of Ignion,**
**Not to disclose or copy without prior written consent**

PCN Number: NN19100012

Notification Date: October 07th, 2019

**Part Number identification:**
Part Number changes, it will be applied in all the document of the company (User Manual, Data Sheet, …)

| Previous Part Number | New Part Number |
|---|---|
| FR01-S4-220 | NN02-220 |

**Reason for change:**

| | | | |
|---|---|---|---|
| | Specs (electrical/mechanical) | | Manufacturing location |
| | User Manual/Data Sheet | | Quality/Reliability |
| | Material/Composition | | Logistics |
| | Processing/Manufacturing | X | Other: Part Number |

**Change description**

1.- Part Number: From FR01-S4-220 FRACTUS to NN02-220 Ignion in the User Manual

OLD


NEW


**Comments:**
1.- Electrical and Mechanical specs remain the same.
2.- Footprint in the PCB to solder the chip antenna remains the same.

**Identification method**
1.- The part number on the antenna is different.

| | | |
|---|---|---|
| User Manual | X | Available from: March 2020 |
| Samples | X | Available from: February 2020 |

Ignion Contact:

| | Sales | Supply Chain |
|---|---|---|
| Name: | Josep Portabella | Albert Vidal |
| Email: | josep.portabella@ignion.io | albert.vidal@ignion.io |